

Date: March 8, 2015
To: Thomas J. Bonfield – City Manager
Through: W. Bowman Ferguson – Deputy City Manager
From: Marvin G. Williams – Director of Public Works
Subject: Authorization of Intergovernmental Agreement with the U.S. Geological Survey for the Measurement of Groundwater entering Lower Ellerbe Creek. (Agenda Item #10965)

Executive Summary

Public Works recently updated a water quality evaluation tool that predicts nitrogen and phosphorus both on land and streams of the Ellerbe Creek watershed. Public Works has recently identified an unknown source of nitrogen in lower Ellerbe Creek. This source has not been accounted for in the past. This unknown source is currently classified as existing development in the Falls Lake Nutrient Management Strategy and is subject to those reductions. The U.S. Geological Survey will conduct a study of groundwater discharge to lower Ellerbe Creek to determine if nutrients in groundwater are the unknown source of nitrogen. The project is anticipated to be completed in 24 months. The total project cost is \$100,000.00 with the U.S. Geological Survey contributing \$40,000.00 and the City of Durham contributing \$60,000.00.

Recommendation

The Administration recommends that the City Council authorize the City Manager to execute an intergovernmental agreement with the U.S. Geological Survey for the measurement of groundwater discharge in Lower Ellerbe Creek for \$60,000.00, with a total project cost of \$100,000.00.

Background

The City of Durham continues to be regulated by the Neuse and Falls Lake nutrient management strategies. Public Works continues to study and evaluate Durham watersheds to determine sources of nitrogen and phosphorus in the area north and east of Highway 147. Public Works recently updated a water quality evaluation tool that predicts nitrogen and phosphorus both on land and streams of the Ellerbe Creek watershed. While performing calculations and updating this tool, known nitrogen sources in upper Ellerbe Creek and sources from the lower Ellerbe Creek watershed were added together. The sum of these nitrogen sources should be consistent with observed nitrogen concentrations in lower Ellerbe Creek. Unfortunately, the sum of the nitrogen sources were not consistent with observed nitrogen concentrations in lower Ellerbe Creek. The known sources did not contribute enough nitrogen to produce the

observed nitrogen concentrations in lower Ellerbe Creek. Therefore, an unknown nitrogen source exists in the lower Ellerbe Creek watershed.

The known sources contributed enough total suspended solids and phosphorus to produce observed concentrations in lower Ellerbe Creek. Therefore, the unknown source of nitrogen does not produce additional total suspended solids or phosphorus. This led staff to believe groundwater could be the source of additional nitrogen. (Nitrogen stays dissolved in groundwater and moves with groundwater. Phosphorus binds to soil particles and becomes relatively immobile.)

Public Works does not maintain expertise to monitor interactions between groundwater and surface water. The U.S. Geological Survey not only employs scientists that can perform the monitoring, but scientists that can also design the field study and interpret the results. The U.S. Geological Survey proposes to perform comprehensive analyses of temperature differences to determine if and where groundwater may be entering Ellerbe Creek. Groundwater temperatures are relatively constant throughout the year, while temperatures in Ellerbe Creek can vary significantly across the seasons. Therefore, temperature is a

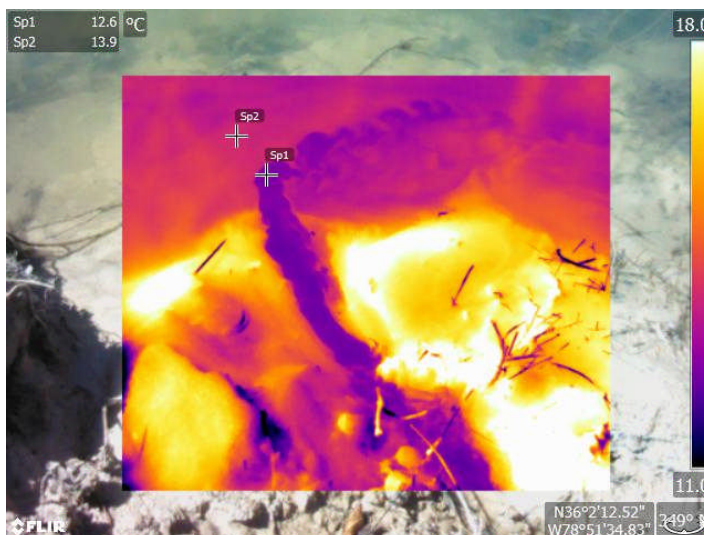


Figure 1. Example of thermal imaging camera output showing a stream bank seep of groundwater (hot pink)

reasonable tracer of groundwater discharge. The field data collection will include thermal imaging (Figure 1) and other methods of identifying groundwater using temperature signatures. Once specific locations of groundwater discharge are determined, the U.S. Geological Survey will collect nitrogen data and determine how much nitrogen enters lower Ellerbe Creek from groundwater discharge. The entire project is anticipated to be completed in 24 months.

Issues/Analysis

Sources of nutrients, including nitrogen, that have not explicitly been accounted for in the nutrient management strategy are assigned to existing development in the Falls Lake Nutrient Management Strategy. Within the Nutrient Management Strategy, each jurisdiction has existing development reduction goals. The unknown nitrogen load is, therefore, currently assigned to land-based nonpoint sources in the City of Durham and Durham County. Determining if groundwater is a nitrogen source, and the significance of this source compared to sources in the watershed, will affect strategies the City and County may use to meet existing development reductions.

Alternatives

The alternative is to deny funding and authorization to negotiate and execute the intergovernmental agreement to measure groundwater discharges to Ellerbe Creek. The unknown source of nitrogen would not be identified, nor would the relative contribution by this source be determined. Without this knowledge, the City would continue to pursue retrofits to existing development. The City may also risk not achieving attainable reductions because an unknown source would not be addressed.

Financial Impact

The total cost for the study is \$100,000.00 with the U.S. Geological Survey providing \$40,000.00 of matching funds. The remaining \$60,000.00 will be paid from the Public Works Stormwater operating budget (Organization code 5500L041, Object code 728600).

SDBE Summary

Not applicable

Attachments

Study Proposal from U.S. Geological Survey
Draft Joint Funding Agreement